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CENTRAL NERVOUS SYSTEM.

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delphia Polyclinic; Associate in the William Pepper
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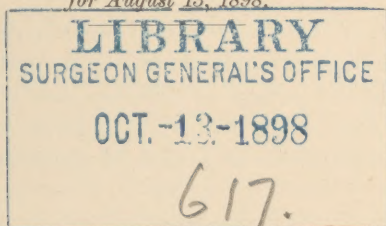
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ON AMYLOID, COLLOID, HYALOID, AND
GRANULAR BODIES
IN THE CENTRAL NERVOUS SYSTEM.*

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[From the William Pepper Clinical Laboratory.]

LAST year I had the privilege, through the kindness of Dr. Lloyd, of presenting to this society specimens from the spinal cord of a man of forty years of age who had died from a disease resembling, in some respects, Landry's paralysis. I was especially impressed by the great number of amyloid bodies in the spinal cord of a person of forty years. It is true that these bodies begin to be quite numerous at this age, and increase in number as life advances. They are indicative of the senile changes which occur in every central nervous system, and they are especially abundant in the olfactory tracts of man. The person to whom I refer had arteriosclerosis of the vessels of the central nervous

* Read before the Pathological Society of Philadelphia, March 10, 1898.

system in a high degree, and we may, perhaps, look upon this as a possible cause of the great number of amyloid bodies present in this case, for it has been said that "a man is as old as his arteries." We do not regard these bodies as a sign of great value in acute

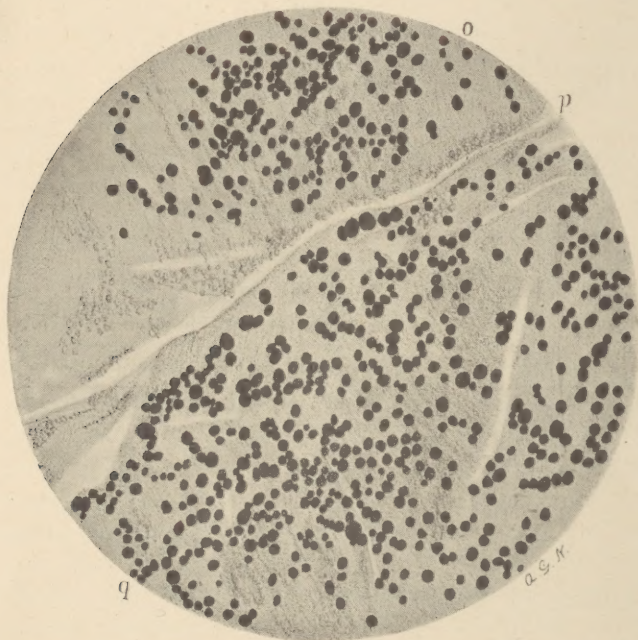


FIG. 1.—Amyloid bodies in a case of meningo-myelitis. *o*, posterior root; *p*, pia; *q*, zone of Lissauer and column of Burdach. (Stained with Lugol's solution.)

degenerative processes, but possibly we do not recognize their full significance. They were found in such large numbers in the case referred to that they seemed to be one of the signs of disease of the spinal cord. They

were present in the posterior columns, within the sæpta, about the vessels and the central canal, and especially within the zones of Lissauer. They extended also a short distance into the posterior roots. (See Fig. 1.)

Redlich * believes that these bodies are derived from the neuroglia cells, but Homén † states that in the spinal cord of a dog, in which he had cut nerve fibres, he was able to find a few amyloid bodies within the degenerated areas twenty days after the operation. He not only found these fully formed, but was able also to observe intermediate stages between these bodies and altered nerve fibres. Homén believes, therefore, that the amyloid bodies are derived from degenerated fibres.

The findings of Karl and Gustaf Petré ‡ are of much interest. These investigators observed numerous amyloid bodies in the spinal cord of a human foetus. They refer to the fact that Redlich has never been able to find them in the nervous system of persons less than eighteen years of age, and they have shown, therefore, that their development may be intra-uterine.

The writer has been able to study these bodies within the central nervous system in a great many cases, and has found that they always present the same appearances. They stain a light purple with Delafield's hæmatoxylin and a reddish-brown with Lugol's solution, which changes to a purplish color on the addition of a little sulphuric acid. They are not exactly the same as the amyloid substance found elsewhere in the body, or as the amyloid bodies of the prostate gland.

* Redlich. *Jahrbücher für Psychiatrie*, 1891, x. Abstract in *Neurologisches Centralblatt*, 1891.

† Homén. *Atlas der pathologischen Histologie des Nervensystems*, No. vi, pp. 12 and 18.

‡ Karl and Gustaf Petré. *Virchow's Archiv*, Band cli, Heft 2.

Dr. Dercum and the writer, in studying a very typical case of amyotrophic lateral sclerosis, have found formations which resemble quite closely the amyloid bodies, and yet differ from them in important respects. They are larger, but are in general round, and when deeply stained are homogeneous. When faintly stained some of them are seen to have a pale central core surrounded by a deeply stained circle, and this in turn is surrounded by a thicker circle of the same shade as the central core. They do not stain with Delafield's hæmatoxylin, methyl green, or acid fuchsine. With gentian violet they are of the same color as the surrounding tissue, but may be detected. They are a deep purple when thionin is employed, but on exposure to light the color soon fades and they become invisible. The tissue in which they are found has been hardened in formalin and alcohol.

These bodies are especially numerous within the medulla oblongata and in the circumvascular spaces of this region, but they extend also into the surrounding tissue. We were at first almost inclined to look upon them as artifacts, but the existence of three rings within some of them, and the fact that they may also be detected with gentian violet and Lugol's solution, although staining like the surrounding tissue, show that this view is not tenable.

They differ from the hyaloid bodies in their reactions to stains; in the number and appearance of their circles, although many are homogeneous; in their globular form and more nearly equal size; and in the absence of a tendency to form irregular masses, except when the tissue has been kept some time in the hardening fluid. When Lugol's solution is employed they stain yellow, while the amyloid bodies are reddish-brown.

W. Bevan Lewis* speaks of peculiar formations under the name of colloid degeneration. These are minute round or oval bodies, from six to twelve microns up to forty microns in diameter, and are frequently found in the central nervous system of the insane. They are supposed by him to be derived from the medullated



FIG. 2.—The so-called colloid bodies in a case of amyotrophic lateral sclerosis. (Stained with thionin.)

nerve fibres. Bevan Lewis acknowledges that the name is unfortunate, for it indicates a colloid transformation

* Lewis. *A Text-book of Mental Diseases*, p. 465.

of neuroglia cells similar to that of epithelial cells, and these bodies are not derived from neuroglia cells. They are spherical, ovoid, or pyriform, and in later stages may also be crenulated, a condition which we also have found. They are homogeneous, devoid of concentric markings, colorless, and pellucid. They may be slightly tinged by hæmatoxylin, but not by carmine or aniline dyes, and they exhibit no reaction with iodine and sulphuric acid. Bevan Lewis observed these bodies in great numbers in a case of bulbar paralysis. They are usually found only in the white matter.

I believe that the bodies found in my case of amyotrophic lateral sclerosis with bulbar symptoms resemble more closely the colloid bodies of Bevan Lewis than any other with which I am familiar. (See Fig. 2.)

In a case of tumor of the base of the brain, in which the symptoms of acromegaly had been observed during life, I have found the hyaloid bodies recently mentioned by Dagonet.* I am indebted to Dr. F. A. Packard and Dr. H. W. Cattell for the pathological material, but shall at present refer to it only in so far as concerns the bodies under consideration.

These are most irregular in shape, and many of them show a concentric arrangement. They vary greatly in size, and in some places form quite large masses. They have little resemblance to the formations previously described, and could hardly be mistaken for those. With Weigert's hæmatoxylin stain they are brown; with eosin, pink; with thionin, purple; with carmine, very pale pink; with Delafield's hæmatoxylin, deep purple; with acid fuchsine, red; with Weigert's fibrin stain, the color

* Dagonet. *Système nerveux central. Coupes histologiques photographiées.*

of the surrounding tissue; with iodine, yellow, like the surrounding tissue; with gentian violet, purple, with a tinge of pink; with Van Gieson's stain, deep reddish

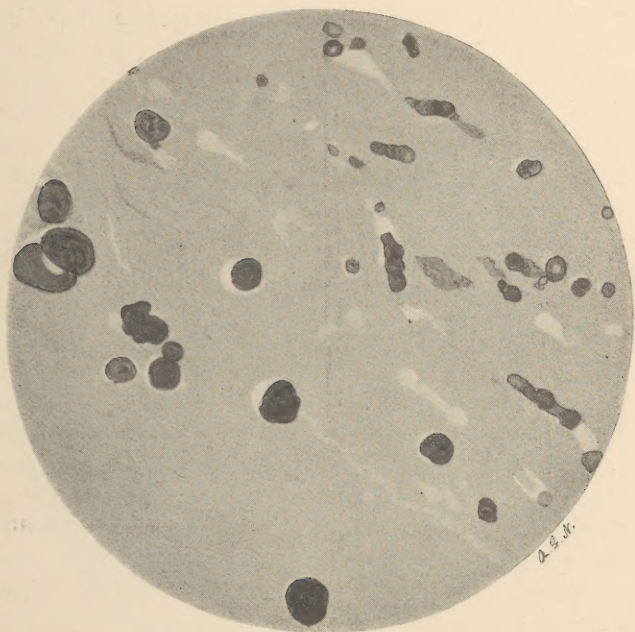


FIG. 3.—The hyaloid bodies in this field are small, and resemble altered vessels.

brown. Boiling water, acid, and alkali do not dissolve them.

They not infrequently have deeply stained edges and pale centres, and each seems to be surrounded by a space very much like that found about the vessels. They are situated in the cortex, and form large, irregular masses in the much-thickened ependyma. Not infre-

quently they are elongated and present much the appearance of thickened vessels, a resemblance which is increased by the space about each of them often extending a short distance beyond them. (See Figs. 3 and 4.)

Edsall and Sailer* have recently spoken of bodies



FIG. 4.—The hyaloid bodies in this field are large and irregular. (Same magnification as in Fig. 3.)

very similar to these, and have referred to the literature bearing on the subject. Since Adler described them, in

* Edsall and Sailer. *Proceedings of the Pathological Society of Philadelphia*, vol. i, No. 4.

1875, comparatively little, according to Dagonet, has been written concerning them.

Careful study has led me, contrary to views originally held, to conclude that probably some of these bodies are thickened vessels. The spaces surrounding them, the concentric rings, much like those I have found in diseased vessels elsewhere, the elongated form of certain of these structures, with surrounding spaces extending further than the hyaloid masses, are very suggestive of diseased vessels. Alzheimer * also found colloid masses separate from the vessels, and believed that they were deposited from the fluid within the tissues. He showed that the chemical reactions of the colloid degeneration of the cerebral vessels are very different in the reported cases, but he does not believe that the degeneration in those cases is essentially different. He states that he regards the possibility of glia or nerve cells undergoing colloid degeneration as very doubtful, although the cells of the vessels may do so.

The granular bodies, the *corps granuleux* of the French, the *Fettkörnchenzellen* of the Germans, are very different structures from those previously mentioned, but like them they are indicative of degeneration. Indeed, in former days, when the microscopical technique was less perfect than at present, their presence was regarded as of great value in determining the existence of degenerative processes.

These bodies may be seen in various diseases of the central nervous system, and I have found them in large numbers a few days after fracture of the spinal vertebræ. I have seen them in masses crowded together close upon one another in processes of long duration.

* Alzheimer. *Archiv für Psychiatrie*, vol. xxx, No. 1.

In old cases of hemiplegia I have found them, when the method of Marchi was employed, filling the circumvascular spaces and leaving the rest of the cord free, so far as could be determined by this method. When examined in the fresh state they are much larger than when a hardening fluid has been employed, and are filled with fat drops.

When they wander into the nervous tissues they seem to be unable to find their way out again. They are quite large cells, and are very numerous in the brain of the newborn, and for this reason it has been thought that they may be instrumental in carrying material for the formation of the medullary sheaths (Obersteiner).*

They are very numerous in all acute forms of degeneration when the nerve fibres are affected, and may be shown by the method of Marchi to be filled with a substance resembling fat. It is believed that they are formed by fatty degeneration of nerve cells, connective-tissue cells (neuroglia ?), and even from the smooth muscular fibres of the vessels (Huguenin, cited by Obersteiner). Guizzetti † states that these cells are derived partly from wandering leucocytes and partly from transformed endothelial elements of the circumvascular lymph sheaths, that they multiply by caryocinesis, and that the ganglion cells and neuroglia cells do not take part in their formation.

I have recently had the opportunity to study vessels in a condition of arteriosclerosis from the region of the pons, and have found large accumulations of these cells

* Obersteiner. *Anleitung beim Studium des Baues der nervösen Centralorgane.*

† Guizzetti. Abstract in *Neurologisches Centralblatt*, No. 5, 1898, p. 211.

within the vascular walls. They are filled with drops of fat, as shown by the osmic acid. They have usually only one round or somewhat elongated nucleus, but, occasionally, two nuclei may be found. They form granular masses in certain parts of the vascular walls, in which the individual cells can be seen only with great difficulty.

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